Bean Tunnel

Specification Appendices - Electrical Work for Road Lighting and Traffic Signs

Kent County Council

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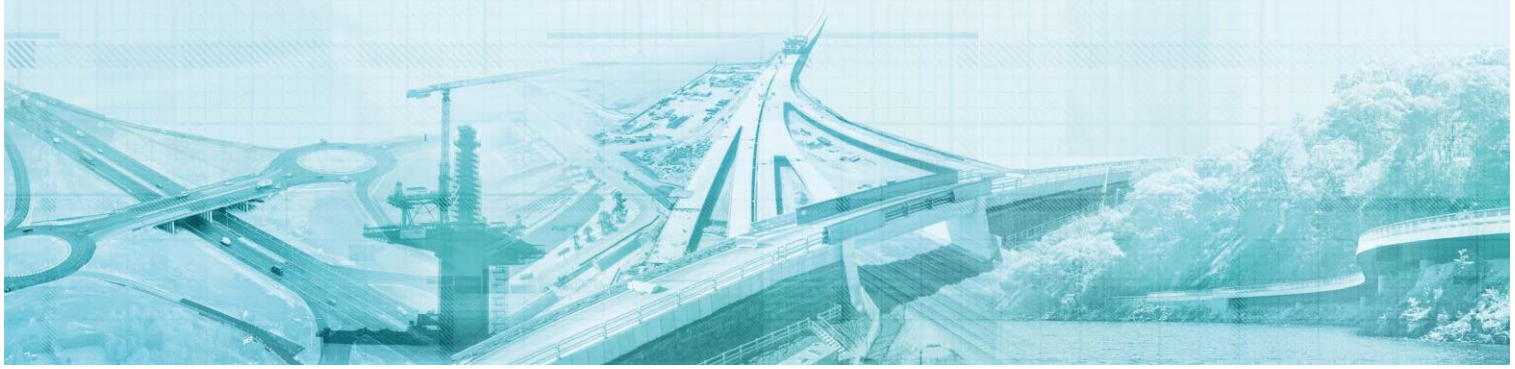

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Issuing Office:	Tony Gee and Partners LLP, Hardy House, 140 High Street Esher, Surrey, KT10 9QJ
Tel:	+44 1372 461600
Email:	esher@tonygee.com

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APPENDIX 14/1 – Site Records

1.1. General

1.1.1. As-Built drawings in the format of the AutoCAD file shall be promptly prepared and provided by the Contractor to KCC and Bluewater in accordance with the requirements of SHW Clause 1402 and shall relate to records supplied in accordance with SHW Clauses 1208, 1402 and 1403.

1.1.2. The Contractor shall promptly provide Electrical Installation Certificates cross-referenced to the lighting and electrical equipment identified on the As-Built drawings. Certificates shall be in accordance with BS 7671:2018+A1:2020 'Requirements for Electrical Installations' IET Wiring Regulations, SHW Series 1400 and shall be in the form of a NICEIC HCN3, HEA certificate or equivalent and approved.

1.1.3. Cable sheath insulation tests shall be undertaken and recorded on a schedule after the cable has been laid and the trench backfilled, and before any cables have been terminated, in accordance with SHW Clause 1424.3.

1.1.4. The Contractor will be provided with two sets of Contract drawings to assist in this purpose and a copy of the AutoCAD file with the site layout and schematic drawings.

1.1.5. The Contractor will also supply a full set of As-Built drawings in print format.

1.1.6. The AutoCAD file shall be updated with the As-Built details and returned to Client with two copies of each drawing no greater than two months after the completion of Works.

1.1.7. The Contractor shall produce As-Built schematic cable layout drawings detailing the following:

i. looped and fused spur circuits.

ii. Key identifying lighting columns, lit traffic signposts and bollards, freestanding sign light units and the like.

iii. Protective device types and rating, including for MCB's, *Ze,* Zs, PSCC value and MCB type.

iv. Phasing.

v. Both construction and maintenance numbers.

vi. Each single schematic drawing shall detail all circuits emanating from one feeder pillar as a minimum.

1.1.8. The Contractor shall produce site layout plans detailing:

i. Depth of cables and / or ducts affected by the scheme.

ii. Offset distances indicating the line of cables or ducts and any change in direction from kerbs, building lines or any other feature unlikely to change position. Offsets of the existing cable shall be taken at 20m intervals where cables maintain a steady line, and at 5m intervals where the line of the cable varies.

iii. Locations of lighting columns, lit traffic signposts and bollards, freestanding sign light units and the like.

iv. Both construction and maintenance numbers.

v. Any known redundant cables left in the ground.

1.1.9. The Contractor shall, prior to carrying out any electrical installation work carry out a site investigation of existing arrangements in feeder pillars, lighting columns and lit traffic signs to verify that they can be altered to accommodate the proposed new arrangements.

1.1.10. The Contractor shall obtain agreement from the Engineer on site on the nature of and for location measurements and daily records.

1.1.11. The Contractor shall, prior to commencing any section of the Works (including setting out level pins or the like) locate all buried cables by means of cable detection equipment i.e., Cable Avoidance Tool (CAT) and Signal Generator (Genny) or arrange and pay for this work to be undertaken by the relevant Maintaining Agents at the time (refer to Appendix 1/16).

1.1.12. The above requirement for measured work shall not prejudice the Contractor's obligations under SHW Clause 116 at other locations.

1.1.13. Insulation integrity tests are required for these located cables within the site as required by SHW Clause 1424.2.

1.1.14. The Contractor shall, on the completion of the electrical work, show the position and identification mark of equipment requiring electrical connections, ducts, buried cables and the type and depth of cables. The positions of the ends of abandoned ducts shall also be shown.

1.1.15. The Contractor shall also provide the Project Manager, on the completion of the electrical work, with all original testing certification as required in Appendix 1/5 cross-referenced to the apparatus identified on the As-Built drawings.

1.1.16. The Contractor shall supply Operations and Maintenance manuals to support the site records.

APPENDIX 14/2 – Location of Lighting Units and Feeder Pillars

1.2. General

1.2.1. The locations and descriptions of all lighting units and feeder pillars shall be as per Lighting Layout drawing nos. BRT-TG-XX-ZZ-DR-LI-1301, BRT-TG-XX-ZZ-DR-LI-1302, BRT-TG-XX-ZZ-DR-LI-1303 and are detailed in Table 14/2-1 and 14/2-2 of this Appendix.

1.2.2. Electrical equipment used for road lighting and lit traffic signs are referenced from Appendix 14/4 and 14/5.

1.2.3. The final locations of all lighting units and feeder pillars shall be accurately recorded on the As-Built drawings described in Appendix 14/1.

1.2.4. Schematic diagrams of underground cable layouts between lighting units and feeder pillars are as per Electrical Line Schematic drawing nos. BRT-TG-XX-ZZ-DR-LI-1401 and BRT-TG-XX-ZZ-DR-LI-1403.

1.2.5. Distribution Network Operator (DNO) supplies to proposed equipment detailed on the drawings shall not be connected prior to the Contractor confirming compliance with BS 7671:2018+A1:2020 'Requirements for Electrical Installations' IET Wiring Regulations.

1.2.6. Where electrical supplies are provided by the DNO, only qualified Electricians holding a current G39/1 certificate and DNO authorisation may remove the fuse.

1.2.7. Columns shall then be installed as per the Lighting Layout drawings mentioned above. Where this is not achievable, the client's representative shall attend site and a request made to give further instructions in writing.

1.2.8. Electrical supplies to all lighting units shall be on a Private Cable Network (PCN).

1.2.9. Columns shall also be deemed to include lit traffic signposts in accordance with TSRGD 2016 within this Appendix.

Table 14/2-1 – Location of Lighting Units.

Lighting Unit Ref. No.	Location		Drawing Ref. No.	Notes
	Easting, X	Northing, Y		
LC05A/B	558384.47	173450.49	BRT-TG-XX-ZZ-DR-LI-1302	
LC08A/B	558411.95	173507.47		

LC01	558434.68	173499.32		
LC02	558447.80	173508.44		
FL001	558461.20	173497.68	BRT-TG-XX-ZZ-DR-LI-1301	
FL002	558462.72	173497.53		
FL003	558464.24	173497.39		
FL004	558465.76	173497.24		
FL005	558467.28	173497.09		
FL006	558468.79	173496.94		
FL007	558470.31	173496.80		
FL008	558471.83	173496.65		
FL009	558473.35	173496.50		
FL010	558474.86	173496.35		
FL011	558476.38	173496.21		
FL012	558477.90	173496.06		
FL013	558479.42	173495.91		
FL014	558480.94	173495.76		
FL015	558482.45	173495.62		
FL016	558483.97	173495.47		
FL017	558485.49	173495.32	BRT-TG-XX-ZZ-DR-LI-1301	
FL018	558487.01	173495.17		
FL019	558488.53	173495.03		
FL020	558490.04	173494.88		
FL021	558491.56	173494.73		
FL022	558493.08	173494.58		

FL023	558494.60	173494.44		
FL024	558496.11	173494.29		
FL025	558497.63	173494.14	BRT-TG-XX-ZZ-DR-LI-1301	
FL026	558499.15	173493.99		
FL027	558500.67	173493.85		
FL028	558502.19	173493.70		
FL029	558503.70	173493.55		
FL030	558505.22	173493.40		
FL031	558506.74	173493.26		
FL032	558508.26	173493.11		
FL033	558509.78	173492.96		
FL034	558511.29	173492.81		
FL035	558512.81	173492.67		
FL036	558514.33	173492.52		
FL037	558515.85	173492.37		
FL038	558517.36	173492.22		
FL039	558518.88	173492.08		
FL040	558520.40	173491.93		
FL041	558521.92	173491.78		
FL042	558523.44	173491.63		
FL043	558524.95	173491.49		
FL044	558526.47	173491.34		
FL045	558527.99	173491.19		
FL046	558529.00	173500.59		

FL047	558527.49	173500.73		
FL048	558525.97	173500.88		
FL049	558524.45	173501.03	BRT-TG-XX-ZZ-DR-LI-1301	
FL050	558522.93	173501.18		
FL051	558521.41	173501.32		
FL052	558519.90	173501.47		
FL053	558518.38	173501.62		
FL054	558516.86	173501.77		
FL055	558515.34	173501.91		
FL056	558513.82	173502.06		
FL057	558512.31	173502.21		
FL058	558510.79	173502.36		
FL059	558509.27	173502.50		
FL060	558507.75	173502.65		
FL061	558506.23	173502.80		
FL062	558504.72	173502.95		
FL063	558503.20	173503.09		
FL064	558501.68	173503.24		
FL065	558500.16	173503.39		
FL066	558498.65	173503.54		
FL067	558497.13	173503.68		
FL068	558495.61	173503.83		
FL069	558494.09	173503.98		
FL070	558492.57	173504.13		

FL071	558491.01	173504.27		
FL072	558489.54	173504.42		
FL073	558488.02	173504.57	BRT-TG-XX-ZZ-DR-LI-1301	
FL074	558486.50	173504.72		
FL075	558484.99	173504.86		
FL076	558483.47	173505.01		
FL077	558481.95	173505.16		
FL078	558480.43	173505.31		
FL079	558478.91	173505.45		
FL080	558477.40	173505.60		
FL081	558475.88	173505.75		
FL082	558474.36	173505.90		
FL083	558472.84	173506.04		
FL084	558471.32	173506.19		
FL085	558469.81	173506.34		
FL086	558468.29	173506.49		
FL087	558466.77	173506.63		
FL088	558465.25	173506.78		
FL089	558463.74	173506.93		
FL090	558462.22	173507.08		
T01	558462.11	173501.83		
T02	558473.18	173500.80		
T03	558484.29	173499.74		
T04	558495.46	173498.70		

T05	558506.55	173497.59		
T06	558517.63	173496.50		
T07	558528.74	558528.74		

Table 14/2-2 – Location of Feeder Pillars.

Feeder Pillar Ref. No.	Location		Drawing Ref. No.	Notes
	Easting, X	Northing, Y		
FP01	558533.77	173500.00	BRT-TG-XX-ZZ-DR-LI-1301	
FP02	558428.31	173509.37	BRT-TG-XX-ZZ-DR-LI-1302	
UPS	558535.19	173499.82	BRT-TG-XX-ZZ-DR-LI-1301	

APPENDIX 14/3 – Temporary Lighting

1.3. Existing Lighting

1.3.1. Existing lighting columns, lit traffic signposts and bollards, freestanding sign light units and the like to be removed or altered as part of the works, shall be maintained in full operation, as far as is reasonably practicable until the new installations have been commissioned. Due to practicalities of construction, any relaxations and requirements for the maintenance of existing installations are detailed in Table 14/3-1 below:

Table 14/3-1 – Relaxations and requirements for the maintenance of existing installations

Item	Requirement or Relaxation	Location	Requirement	Notes
1	Requirement	Existing feeder pillars		
2	Requirement	If the existing lighting cannot be maintained, temporary lighting is to be provided as detailed below		

1.4. Temporary Lighting

1.4.1. Temporary lighting required by the Project Manager shall comply with the following:

a) Approvals required by SHW Clause 1404.1 will only be given when temporary lighting is operational, unless a relaxation has been granted above.

b) The Contractor shall provide temporary lighting to indicated standards in the following situations

c) The Contractor shall provide temporary lighting in accordance with BS 5489-1:2013. The Contractor shall demonstrate by lighting calculation using an approved lighting design software and / or measurement that the installation complies as per recommendations.

d) Luminaires used for temporary road lighting shall have a minimum luminous intensity class of G3 as defined in BS EN 13201-2:2015 Annex A. The Contractor shall ensure that luminaires provided do not cause disability glare on motorised traffic or obtrusive light into any neighbouring property.

e) Existing lit regulatory traffic signs, where not part of a traffic signal installation, must be maintained either in their existing or temporary locations and the same standard of illumination maintained by either existing or temporary lighting. This lighting is to be maintained until the relevant regulation ceases to be appropriate and may not be removed without the prior approval of Bluewater in writing.

f) The Contractor may if he wishes, propose the advance installation of fixed road lighting units in their final positions to fulfil the requirements above. However, the Contractor will be fully responsible for any damage which may occur to such equipment before final handover.

g) The Contractor shall ensure that all existing road lighting remains in operation for as long as that road is open to traffic. Where electrical supplies to existing units are disconnected during the execution of Works, the Contractor shall provide and install temporary supply cables as directed by the asset owner.

h) The precise position of each lighting unit shall be agreed with the Supervisor. The Contractor shall ensure that each lighting unit is separated from traffic by an approved method. Each lighting unit shall be supported so that it is vertical and stable at all times.

i) The Contractor shall ensure that each temporary lighting unit is protected by temporary road restraint barrier where appliable in accordance with DMRB CD 377 (formerly TD 19/06), where required.

j) The requirements and limits for control of noise as detailed in Appendix 1/9 are to be adhered to during the operation of any temporary lighting system.

k) The Contractor shall provide for temporary lighting where the existing installation cannot be maintained to meet the requirements of BS 5489-1:2013 and BS EN 13201 as required in Table 14/3-2 below:

Table 14/3-2 – Temporary lighting requirements		
Location	**Design Standard**	**Lighting Class**
Bluewater Parkway	BS EN 13201:2015 / BS 5489-1:2013	C2
Bluewater Parkway [New Junction]		C1

APPENDIX 14/4 – Electrical Equipment for Road Lighting

1.5. Particular Requirements

1.5.1. The Contractor shall ensure the correctness and compatibility of all equipment to be installed as stated in the Contract.

1.5.2. The Contractor shall insert in the following Tables, details of the equipment which he proposes to use in the Works and shall submit the information prior to starting the Works.

1.5.3. This Appendix shall be read in conjunction with Lighting Layout drawings BRT-TG-XX-ZZ-DR-LI-1301, BRT-TG-XX-ZZ-DR-LI-1302, BRT-TG-XX-ZZ-DR-LI-1303, Electrical Line Schematic drawings BRT-TG-XX-ZZ-DR-LI-1401 [Tunnel lighting], BRT-TG-XX-ZZ-DR-LI-1403 [Junction Lighting], BRT-TG-XX-ZZ-DR-LI-1404 [FP01 layout] and BRT-TG-XX-ZZ-DR-LI-1311 [FP02 layout].

1.6. Road Lighting Luminaires General Requirements

1.6.1. Luminaires shall be as follows:

1.6.2. COLORGRAZE MX4 POWERCORE_LED_RGBW_ 323.6 LUMEN (BLUE)_OPTIC 30° x 60°_DMX_74W_1219MM from Colorkinetics for the blue feature lighting.

1.6.3. BGP237_TUBEPOINT GEN2 LARGE from Signify for the functional lighting.

1.6.4. DW Windsor RIO 500 LED luminaire.

1.6.5. BGP704_LUMA Medium from Signify for the junction lighting (LC01 and LC02)

1.6.6. All luminaires shall be mounted as specified on the above-mentioned Lighting Layout drawings.

1.6.7. Luminaires shall be installed in accordance with the manufacturer's recommendations.

1.6.8. Road lighting luminaires shall be made tight and securely mounted to the column in a side entry to a bracket arm as per Table 13/1-1 of Appendix 13/1, to the required torque settings using a calibrated torque wrench and in accordance with the manufacturer's recommendations. The fixture arrangement shall allow adjustment and ensure that once set-in position, the luminaire will not be subject to further movement.

1.6.9. Luminaires shall maintain the luminaire horizontal tilt inclination as per Table 13/1-1 of Appendix 13/1.

1.6.10. Method of lighting control as per Table 14/4-1.

1.6.11. Luminaires shall conform to the requirements of the appropriate sections of the EU Restriction of Hazardous Substances (RoHS) Directive 2011 and The Waste Electrical and Electronic Equipment (Amendment) (No. 2) Regulations 2018.

1.6.12. The luminaires shall be compatible with the columns offered in Appendix 13/2 and the information in Table 14/4-1 shall be completed.

Luminaire Reference	**Type 1**	**Type 2**	**Type 3**	**Type 4**
Quantity	**2**	**4**	**7**	**90**
Manufacturer	Signify	DW Windsor	Signify	Colorkinetics
Product	BGP704 (LUMA Medium)	RIO 500	BGP237 Large Tubepoint	Colorgraze MX4 powercore
Reference	LUMA GEN2 MEDIUM_BGP704_DN33 BL2_15000_80LED_5.2S_CLO_L90_830	RI5_PL64_40_A3_0400 _S_U+DIMMING	BGP237_TUBEPOINT GEN2 LARGE_LED_4000K_780 00 LUMEN_OPTIC DNS11_DALI_475W	COLORGRAZE MX4 POWERCORE_LED_ RGBW_ 323.6 LUMEN (BLUE)_OPTIC 30°X 60°_DMX_92W_1219MM
Fixing arrangement	Side Entry	Side Entry	MBA bracket	Multi position, constant torque locking Hinge bracket
Optical setting	DN33 BL2	A3	DNS11	30˚ x 60˚
IP rating	IP66	IP65	IP66	IP66
IK rating	IK10	IK07	IK09	IK10
Body material	Aluminium	Aluminium	Aluminium	Aluminium
Protector / glazing type	Flat Glass	Flat Glass	Glass	Polycarbonate
Finish	Polyester Powder Coating (Bluewater Aubergine) to match column	Polyester Powder Coating (Bluewater Aubergine) to match column	Dark Grey	N/A
Dimensions	743mm x 360mm x 146mm	750mmØ x 276mm	L = 1090mm x W = 486mm x H = 90mm	L = 1219mm x W = 53mm x H = 68mm

Luminous intensity class	G6	G3	G3	N/A
Weight	11.5kg	20.0kg	23.0kg	4.2kg
Windage (EPA)	0.063m²	0.14m²	0.53 m² (Effective projected area)	N/A
No of LEDs	80	64	TBC	RGBW
LED driver current	TBC	400mA	TBC	TBC
LED wattage	107W	66W	475W	92W
LED luminous flux / lumen output	15.00klm	11.52klm	78.00klm	3.23klm
LED colour code	830	740	740	RGBW
LED correlated colour temperature (CCT)	3000K	4000K	4000K	n/a
LED colour rendering index (CRI)	>80	>70	>70	>70
Control gear type	Pre-programmed dimming via electronic control gear	Pre-programmed dimming via electronic control gear	Electronic control gear (DALI)	Electronic control gear (DMX)
Control	Part Night Dimming	Part Night Dimming	Astro Time Switch	Astro Time Switch
Socket type	Photocell	Miniature Photocell	n/a	n/a

1.7. Photo-Electric Control Units (PECUS)

1.7.1. All column mounted luminaires shall be individually controlled via PECUs.

1.7.2. Each road lighting unit shall be fitted with an external one or two-part miniature PECU.

1.7.3. The miniature PECU shall be fully CE marked and compatible with the luminaire specified.

1.7.4. The internal or external PECU shall have an ingress protection rating of IP67 to BS EN 60529.

1.7.5. For proposed column mounted luminaires, the switching regime and dimming requirements shall be as per the existing lighting installation.

1.7.6. Shorting plugs shall not be used.

1.7.7. Where applicable, PECU's shall be fully approved by ELEXON and the Balancing and Settlement Codes (BSCs) for Unmetered Supplies (UMS), complete with 13-digit charge codes used within the Unmetered Supplies Operator (UMSO) systems to calculate volumes of electricity consumed.

1.8. Lightning Current and / or Surge Protection

1.8.1. Lightning current and / or surge protection shall be as per the that stated for each luminaire.

1.9. Isolator Enclosures

1.9.1. Isolator enclosures shall be installed in accordance with the manufacturer's recommendations.

1.9.2. Isolator enclosures shall be securely and vertically mounted into position onto the lighting column, lit traffic signpost or bollard backboard with screws constructed of mild steel to BS EN 10111 - DD11 or BS EN 10139 - DC01, zinc plated to BS EN ISO 2081

1.9.3. Secondary isolation to be the LSI range (2,3 and 4 as appropriate) from Charles Endirect or similar, equal and approved.

1.9.4. All incoming and outgoing SWA cables shall be made off onto a removable single brass gland plate using CW compression glands and be provided with blanking plugs where required. The plate shall come pre-drilled with minimum M6 earth studs complete with fitting and locking arrangement for crimp terminals to allow connection of protective conductors and extraneous bonding conductors, both internal and external. The exposed SWA shall be insulated outside the isolator enclosure using a shroud over the top of the cable outer insulation. The gland plate shall come with the glands suitably stopped up with a PVC bung which can be removed or left in place in the spare glands.

1.9.5. The conductor terminations shall be shrouded and only removed with the use of a tool with a separate terminal available for earthing which shall be wired with 10mm² flexible 'green / yellow' bonding conductor to the gland plate.

1.9.6. A 32A double pole isolation switch, surge arrester, and fuse carrier(s) shall be housed within each isolator enclosure.

1.9.7. The fuse carrier shall be minimum current rating of 32 amps and be able to house BS 88-1 Class Q1 type A (LD for 230V) (not ST or LST) high rupturing capacity cartridge type fuse-links.

1.9.8. The isolation switch, surge arrester and fuse carrier(s) shall be mounted on a DIN rail.

1.9.9. The isolator enclosure shall come pre-wired between the isolation switch, surge arrester, fuse carrier(s) and the incoming cable terminations with line, earth and neutral terminals fitted with suitable separators. Any separable parts which allow access to live terminations must be held together by slot headed bolts or screws, with lock washer. A removable insulating shroud shall be installed within the unit, covering all line conductors.

1.9.10. Isolator enclosures shall have terminals capable of accepting up to 25mm² 3-core cables.

1.9.11. The terminals shall be fitted with shields as a means to prevent accidental direct contact with exposed live conductors or parts.

1.9.12. The access cover to the isolator and fuse carrier shall be translucent, hinged and have the facility to be locked off using a miniature padlock.

1.9.13. Fuse-links and din rail terminal blocks shall be rated accordingly, and appropriately specified to the maximum load current and fuse discrimination.

1.9.14. Din rail terminal blocks shall be of the appropriate number and cable conductor colour, dictated by the number of cable conductors; and sized in accordance with the cable conductor cross-sectional area.

1.9.15. Isolator enclosures shall have an ingress protection rating of IP42 or greater to BS EN 60529.

1.9.16. Isolator enclosures shall be constructed of a self-extinguishing thermoplastic material (ABS, PVC, PP OR PE).

1.9.17. Each cable terminated onto the gland plate shall have cable identification markers as per the Standard Detail drawing(s). The cable identification markers shall provide a means to identify cables at both ends, indicating the circuit number, incoming

supply / source and outgoing destination reference number of each lighting asset. Reference numbers shall be as per the Lighting Layout drawing(s).

1.9.18. Protective devices shall be suitable for use at the prospective short circuit fault levels.

1.9.19. Isolator enclosures shall be as per the specified termination types as per the Standard Detail drawing(s) KCC/SD/1400/010 and KCC/SD/1400/014.

1.9.20. Circuit protection shall be rated as per the schematic layout shown on Electrical Line Schematic drawing(s) BRT-TG-XX-ZZ-DR-LI-1401 and BRT-TG-XX-ZZ-DR-LI-1403.

1.10. Circuit Protective Devices

1.10.1. Circuit protective devices i.e., fuse-links, MCBs, RCDs, RCBOs, etc. shall be rated as per the schematic layouts shown on the Electrical Line Schematic drawing(s) BRT-TG-XX-ZZ-DR-LI-1401 and BRT-TG-XX-ZZ-DR-LI-1403.

1.11. Base compartment Fixing Arrangements

1.11.1. Where a lighting unit is replaced, the existing internal electrical equipment shall not be transferred to the new lighting unit. New electrical equipment shall be provided.

1.11.2. Lighting columns and lit traffic signs shall be provided with backboard constructed of hardwood or other non-hygroscopic material, i.e., marine plywood; treated with a moisture repellent clear lacquer. The backboard shall be at least equivalent to the door size of the lighting column or lit traffic sign. The backboard will be fixed in the base compartment by welded backboard retainers and flush fitting stainless steel screws. The backboard will be suitable for the connection of all electrical equipment as required.

1.11.3. All lighting and electrical equipment shall be bonded to a dedicated 8-way brass earth terminal block mounted on the backboard.

1.11.4. ‘Public’ LV DNO service cut-outs and ‘Private’ LV PCN isolator enclosures shall be located within the base compartment, securely and vertically mounted to the backboard of the associated lighting unit with screws constructed of mild steel to BS EN 10111 - DD11 or BS EN 10139 - DC01, zinc plated to BS EN ISO 2081

1.11.5. No item within the lighting unit base compartment shall obscure the equipment identification marker.

1.11.6. Electrical equipment installed within the base compartment of lighting columns, lit traffic signs and bollards shall be positioned as per the Standard Detail drawing(s).

1.12. Feeder Pillars

1.12.1. Feeder pillar (FP02) internal requirements shall be as per standard detail drawing BRT-TG-XX-ZZ-DR-LI-1311, each item to be installed as per manufacturers recommendations.

1.12.2. Feeder pillar (FP01) internal requirements shall be as per standard detail drawing BRT-TG-XX-ZZ-DR-LI-1404, each item to be installed as per manufacturers recommendations.

1.12.3. Feeder pillar (FP01) shall be installed as per manufacturers recommendations.

1.12.4. Feeder pillar (FP02) to be installed as per manufacturers recommendations and standard detail drawing KCC/SD/1400/030.

1.12.5. The labelling for feeder pillars shall be as per standard detail drawing KCC/SD/1400/032.

1.12.6. Each feeder pillar shall be installed with an earth electrode as per standard detail drawing KCC/SD/1400/033.

1.12.7. Source destination labelling shall be as per standard detail drawing KCC/SD/1400/002.

1.12.8. Before any feeder pillars are installed, trail holes should be hand dug to confirm the suitability of location prior to commencement of works.

1.12.9. The Contractor shall provide and install all equipment including all necessary cabling. The Contractor shall be responsible for ensuring the appropriate rating of all isolators and fuse-links, etc are fitted and installed accordingly.

1.12.10. The size of the door opening shall be clearly indicated on the Contractor's drawings. A baseboard of hardwood or other non-hygroscopic material suitable material shall be fixed in each feeder pillar and shall be of sufficient size to accommodate all DNO service cut-outs and cable terminations. The feeder pillar shall be fixed to a concrete base to be provided by the Contractor and the Contractor shall ensure that the cables can easily be withdrawn from the feeder pillar.

1.12.11. Provision shall be made in the base of each feeder pillar for the termination of the incoming supply cable and associated metering arrangements where this is provided by the Distribution Network Operator (DNO). The Contractor shall liaise with the DNO provider and ensure the correct electrical supply rating is provided for the schematic layouts shown on the Electrical Line Schematic drawing(s).

1.12.12. Feeder pillars shall be adequately earthed in accordance with BS 7671:2018+A1:2020 'Requirements for Electrical Installations' IET Wiring Regulations.

1.12.13. Labelling and warning notices shall be provided to enable ready identification of all protective, switching and isolating devices, with warning notices regarding isolation, and the presence of voltage, appropriately positioned. Outgoing circuit breakers / HRC fuse-links and their respective outgoing terminals in the termination unit shall be labelled.

1.12.14. A warning label indicating the supply voltage shall be fixed to the outside of the feeder pillar.

1.12.15. A copy of the agreed and completed as-built layout and schematic drawings as detailed in Appendix 14/1 shall be encapsulated on a non-biodegradable material and fixed to the inside of the feeder pillar doors.

1.12.16. Where required, a hard-standing area shall be provided to the front and / or rear of the feeder pillar doors.

1.12.17. A hasp and staple shall be provided and suitable for accepting a tamperproof and non-corroding padlock. Two sets of keys shall be provided with each delivery

1.12.18. The door(s) shall have an area of at least 80% of that of the backboard and be of either cast or sheet steel of 6mm thickness and swinging through an angle of least 120 degrees, fitted with carriage type locks recessed behind a brass plug.

1.12.19. A circuit schematic diagram label showing the outgoing circuits shall be mounted on the inside of the pillar door. The label to be manufactured from rigid plastic, pre-printed, mechanically and adhesive mounted. Lettering to be 3.5mm high in black on a white backboard.

1.12.20. A clear plastic holder shall be fitted onto the inside of the door of each feeder pillar. An "as constructed" drawing on non-biodegradable material identifying all the equipment that the feeder pillar supplies shall be placed in this holder.

1.12.21. The manufacturer and the catalogue number shall be provided to the Overseeing Organisation for each feeder pillar.

1.13. Armoured Cable Terminations

1.13.1. All metal gland parts shall be brass, bright dipped and the gland shall consist of gland body with an armour clamping cone and locking ring, armour nut, brass skid washer.

1.13.2. The gland shall be of such a design that during assembly no torque will be induced in the cable sheath or armour. Also, over tightening of the seals when clamping armour wires shall be prevented.

1.13.3. Each gland shall be locked onto equipment gland plates with suitable brass locknuts. Also, at every gland a PVC shroud shall be fitted over the gland for additional protection.

1.13.4. All conductors shall be individually identified L for Live, N for Neutral and E for Earth and shall comply with the cable colour harmonisation which shall be maintained throughout the cable length.

1.14. Electrical Equipment Fixed to Tunnel Walls

1.14.1. Where it is necessary to fix cables to the façade of walls and structures it shall be protected by means of Barton Class 4 galvanised heavy gauge rigid steel conduit or cable shield within 2.5m of ground level unless otherwise non-accessible by the general public.

1.14.2. 'Public' LV DNO and / or 'Private' LV PCN service supplies shall be terminated in mini feeder pillars and / or columns adjacent to the structure sited.

1.14.3. All terminations of surface mounted cable are to be completed using glands of approved manufacture. The making-off of such glands shall be in accordance manufacturers recommendations and only be undertaken by suitably qualified personnel.

1.14.4. The use of junction or termination boxes shall be restricted to those locations adjacent to the wall brackets where it is necessary to terminate the surface cable and to provide a heat resistant flexible cable [within a flexible conduit if necessary] from the box to the lighting unit.

1.14.5. Cables shall be supported on the tunnel wall where required using approved Class 4 galvanised perforated steel cable tray, saddles or cleats, the spacing of which shall conform to the recommendations of BS 7671:2018.

1.14.6. Any electrical risers should be formed of suitably sized class 4 galvanised steel cable tray secured directly to the profile of the tunnel lining behind cladding. A removable section of cladding should be formed to cover the electrical riser section to form part of the final cladding installation retaining all properties required. All cables should be securely fixed to class 4 galvanised steel perforated cable tray.

1.14.7. The internal surfaces of all fixing holes drilled into walls or other structures shall be sealed with an approved silicone sealant prior to the insertion of the fixing bolts.

1.14.8. All service boxes and / or wall mounting brackets shall be installed to provide the designed mounting height of the luminaire above ground level.

1.14.9. All fixings and methods of installation on the inside of the tunnel shall be approved for use by the tunnel designers.

1.14.10. Wiring between the Feeder Pillar and the luminaire shall be undertaken using cables specified in Table 14/4-5 and as per the electrical schematics BRT-TG-XX-ZZ-DR-LI-1401, BRT-TG-XX-ZZ-DR-LI-1403 and BRT-TG-XX-ZZ-DR-1303. All cable glands shall be fitted with PVC shrouds.

1.15. Uninterruptible Power Supply - UPS

1.15.1. The UPS shall be installed as per manufacturers recommendations for ground mounting installation.

1.15.2. The location of the UPS is shown on drawing no. BRT-TG-XX-ZZ-DR-LI-1301.

1.15.3. Refer to drawing no's BRT-TG-XX-ZZ-DR-LI-1401 and BRT-TG-XX-ZZ-DR-LI-1403 for wiring information between UPS and feeder pillar.

1.15.4. Internal wiring and connection shall be as per manufacturers recommendations.

1.15.5. The UPS consists of the following:

a) Ground mounted ALPHA ATROX 55_2000w 60AH IP55 Cabinet

b) ALPHA FXM HP 2000 rugged UPS module

c) ALPHACELL gel batteries.

1.15.6. UPS batteries located in the base of the cabinet are to be positioned such that they do not impede or restrict the cable entry point/s.

1.16. Diversions, Site Investigations and Cable Location

1.16.1. Where the specification of existing underground cables is unknown, the Contractor shall undertake electrical testing and inspection to determine the construction type, cross-sectional area and number of core conductors, in accordance with Appendix 14/1.

1.16.2. The Contractor shall divert existing, proposed or unknown cables around obstructions and / or equipment where required. Prior to the commencement and following the completion of Works, the Contractor shall undertake electrical testing and inspection on the cable to determine the condition, before and after the diversion has been undertaken.

1.16.3. The Contractor shall undertake a site investigation to confirm the location of existing and / or unknown underground cables and / or equipment where required.

1.17. Wiring

1.17.1. Cable terminations for LC01 and LC02 shall be type 8 as per standard detail drawing KCC/SD/1400/010.

1.17.2. Cable termination for LC05A/B and LC08A/B shall be type 12 as per standard detail drawing KCC/SD/1400/014.

1.17.3. The wiring shall be PVC or XLPE insulated and sheathed multi-core flexible wiring with integral earth continuity conductor.

1.17.4. All wiring shall have copper conductors.

1.17.5. All conductors shall be individually identified 'L' for live / phase, 'N' for neutral and 'E' for earth / circuit protective conductor and shall comply with Table 51 of BS7671:2018+A1:2020. Every core shall be identifiable by colour throughout its length. All cables shall be labelled appropriately at the point of each termination. Labels shall be an approved proprietary type. No handwritten labels.

1.17.6. All cable lengths are estimated and should be confirmed on site.

1.17.7. All wiring / cables colours shall comply with BS 7671:2018+A1:2020 Requirements for Electrical Installations of the IET Wiring Regulations; the conductor insulation layer and sleeving of conductors shall be 'brown' for the live / phase conductor, 'blue' for the neutral conductor and 'green / yellow' for the earth / circuit protective conductor.

1.17.8. The minimum size of circuit protective conductors shall be 2.5mm² PVC insulated coloured 'green / yellow,' unless specified / provided by the manufacturer.

1.17.9. The minimum size of conductors shall be 2.5mm² to lighting units of all nominal heights, unless specified / provided by the manufacturer.

1.17.10. The minimum size of internal wiring conductors of lighting units shall be 2.5mm² PVC / PVC single core or multi-core flexible cable, unless specified / provided by the manufacturer.

1.17.11. The method of wiring shall as per the Standard Detail drawing(s).

1.17.12. Domestic grade 3-core flat 'twin and earth' cable shall not be permitted.

1.17.13. All unused conductors shall be made safe; reduced cut to a suitable length, unobtrusively stowed and have sealed ends.

1.17.14. Wiring, cables and cable tails shall not directly contact the inner surfaces of column doors; be located adjacent to hinges, sharp metal edges, fixing screws or the like. The Contractor shall ensure that conductor insulation is protected from being penetrated, cut, abraded, crushed or by any other means of physical damage.

1.17.15. Wiring / cables shall ideally be housed inside lighting columns, lit traffic signposts and bollards, freestanding sign light units and the like; wall and / or stiffening members. Externally fixed wiring / cabling shall be secured using appropriate containment methods in accordance with the requirements of BS 7671:2018+A1:2020 Requirements for Electrical Installations of the IET Wiring Regulations.

1.18. Earthing

1.18.1. The whole of the installation shall be earthed in accordance with the requirements of BS 7671:2018+A1:2020 Requirements for Electrical Installations of the IET Wiring Regulations, BS 7430:2011+A1:2015 'Code of practice for protective earthing of electrical installations and the requirements of the DNO provider where applicable.

1.18.2. The main earth conductor between the isolator enclosure earth terminal and the lighting column, lit traffic sign or bollard earth terminal shall be a minimum of 6mm² CU / PVC insulated single core cable coloured 'green / yellow' and not less than that of the neutral conductor at the point of supply.

1.18.3. The earth continuity conductor connecting the door to the dedicated 8-way brass earth bonding terminal block in the base compartment shall not be less than 10mm² CU / PVC insulated single core cable coloured 'green / yellow' and of a suitable length to ensure that the door can be laid flat on the ground without stressing the conductor.

1.18.4. A sound mechanical and electrical connection must be made between the earth continuity conductor and each item of exposed metal.

1.18.5. The earth continuity conductor point of origin inside lighting columns, lit traffic signs or bollards, etc. shall be the incoming supply fused cut out as detailed in the drawings.

1.18.6. Mechanical fixtures shall not be used as a conductive path to earth in place of a specific, correctly selected, rated, terminated, and installed earthing conductor.

1.19. Earth Electrodes and Inspection Pits

1.19.1. Where required by the schematic drawings, earth electrodes shall be located as per the lighting layout drawings.

1.19.2. Earth electrodes and inspection pits shall be installed in accordance with the manufacturer's recommendations and as per standard detail drawing KCC/SD/1400/033.

1.19.3. All earth rods and installations shall conform to and be tested by the approved method as stated in BS 7430:2011+A1:2015, BS 7671:2018+A1:2020 Requirements for Electrical Installations of the IET Wiring Regulations.

1.19.4. Earth electrodes, i.e., rods, shall be located in an earth rod core and housed / surrounded by a purpose made inspection pit.

1.19.5. Inspection pits shall be to minimum dimensions L450mm x W450mm x H450mm and constructed of pre-cast concrete.

1.19.6. Inspection pits shall have a non-trip and non-slip plain lid.

1.19.7. Inspection pits shall have a minimum vertical loading of 4,500kg (4.43t).

1.19.8. A minimum of three 1200mm x 12.5mmØ earth rods are to be installed; earth rods of a larger dimension may be specified where ground conditions are adverse.

1.19.9. Earth rods shall be constructed of pure copper molecularly bonded onto a low carbon steel core.

1.19.10. Threaded couplings to be constructed of high copper alloy.

1.19.11. The structure earth electrode shall have an earth loop impedance resistance no greater than 20Ω in dry ground conditions and should be as low as practically possible to ensure stability.

1.19.12. Additional earth electrodes may be installed on substantial cable runs with the earthing conductor connected in series via earth rod to cable clamps, should the required resistance value not be initially achieved.

1.19.13. A high-performance low resistance earthing compound 2:1 ratio mix with cement or a granular moisture retaining sodium activated montmorillonite clay earth electrode backfill where ground conditions are adverse may be permitted following approval in writing.

1.19.14. A 'SAFETY ELECTRICAL CONNECTION DO NOT REMOVE' label to BS 951 shall be securely fixed into position onto the earth rod.

1.20. Cables to be used in this contract

1.20.1. Cables to be used in this contract are detailed in Table 14/4-5 below:

Table 14/4-5 – Cables to be used in this contract
10mm^2 single core Cu / PVC 'green / yellow' earth cable (CE marked, BASEC approved)
6mm^2 single core Cu / PVC 'green / yellow' earth cable (CE marked, BASEC approved)
1.5mm^2 single core Cu / PVC 'BROWN' earth cable (CE marked, BASEC approved)
1.5mm^2 single core Cu / PVC 'BLUE' earth cable (CE marked, BASEC approved)
2.5mm^2 3-core Cu / EPR / PCP flexible rubber cable (CE marked, BASEC approved)
16mm² 3core Cu / XLPE / PVC / SWA / PVC cable (CE marked, BASEC approved)
FP Plus. Prysmian 2.5mm² 4 core White (CE marked, BASEC approved)
FP Plus. Prysmian 2.5mm² 3 core White (CE marked, BASEC approved)
Leader Cable with Terminator, CE/PSE, 3.0m (10ft)
Jumper Cable, bespoke length as agreed with manufacturer
DMX (Belden 1352ALSH0)
318-TRS/HOSRR-F (EN505-2-21 LSH

1.21. Cables Identification Markers

1.21.1. Cable identification markers shall be installed in accordance with the manufacturer's recommendations and as per standard detail drawing KCC/SD/1400/002.

1.22. List of Contractors Proposals

1.22.1. The Contractor is to complete the following table for his proposals. Completed Data Sheets shall be provided for all items offered.

Table 14/4-8 – List of Contractor's proposals

Clause	Item	Manufacturer	Type / Catalogue Number	Particular Requirements
1408	LEDs			
1409	Central Management Systems (CMS)			
	Photocells (PECUs)	Lucy Zodion	SS12 20mmø miniature one or two-part PECU 1:0.5 NEG 35 / 18 lux switching	
			SS6 one-part PECU 1:0.5 NEG 35 / 18 lux switching	
			7-pin NEMA socket	
-				
1412	Electronic Control Gear			
1416	Isolator enclosures	Charles Endirect Ltd or Tofco Ltd		Lock off isolation facility
1417	Fuse-link Carriers			Lock off isolation facility
	Fuse-links			High Breaking Capacity (HBC)
	MCBs			Type C including lock off facility

	RCDs	Hager Ltd	DIN rail mounted SP+N 2P 100A 300mA AC S Class RCD CP284U (TT systems)	
			DIN rail mounted TP+N 4P 100A 300mA AC S Class RCD CP484U (TT systems)	
	RCBOs			
-				
1418	Feeder Pillars	Charles Endirect Ltd, Haldo, Lucy or Pudsey Diamond		3mm hot dipped galvanised steel to BSEN ISO 1461.
1419	Wiring			
1421	Underground and Ducted Cable			
-	Cable Identification Markers	Hellermann Tyton	Identification plate - Arrowtag AT3 article no. 151-41310 Cable marker - Ovalgrip LFH straight cut marker type HOBS85.	
1422	Cable Joints			
1423	Armoured Cable Terminations			
1424	FP Plus Cable Terminations			
	PHAROS Touch Panel Control (TPC)	Pharos Controls from Lite-Ltd	TPC BB	

	PHAROS POE	Pharos Controls from Lite-Ltd	Unmanaged PoE Ethernet Switch (4+2 Port: 4 PoE, 2 non-PoE)	
	PHAROS PSU	Pharos Controls from Lite-Ltd	Power Supply (48VPSU15W)	